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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B25B 23/14, 23/142, F16B 31/02	A1	WO 92/03262
		(43) International Publication Date: 5 March 1992 (05.03.92)

(21) International Application Number: PCT/AU91/00370

(22) International Filing Date: 19 August 1991 (19.08.91)

(30) Priority data:
PK 1938 24 August 1990 (24.08.90) AU

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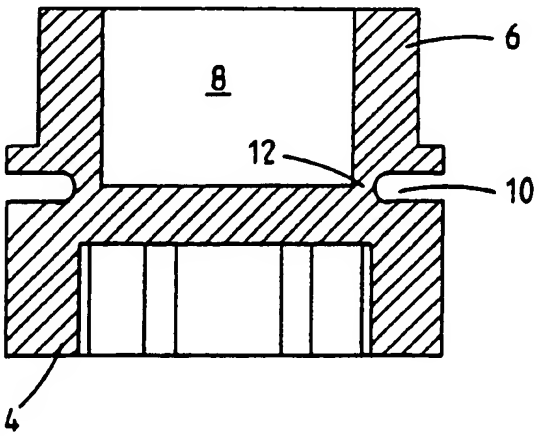
(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU+,TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.

(54) Title: TIGHTENING DEVICE FOR A THREADED FASTENER



(57) Abstract

A torque-limiting driving socket for a nut or bolt comprises a socket portion (4) which receives the nut or bolt head and a hexagonal driving portion (6) for engagement with a spanner or wrench. The driving portion (6) is connected to the socket portion (4) by a thin-walled annular zone which breaks upon the application of a predetermined torque to separate the driving portion (6) from the socket portion (4). The socket is integrally moulded in a plastics material and the torque characteristics can be modified by modifying the thickness of the annular zone (12) by the incorporation of suitable inserts into the mould.

+ See back of page

INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)[6]

According to International Patent classification (IPC) or to both National Classification and IPC

Int. Cl.[5] B26B 23/14, 23/142, F16B 31/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B26B 23/14, 23/142, F16B 31/02

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category*	Citation of Document, [11] with indication, where appropriate of the relevant passages [12]	Relevant to Claim No [13]
X	AU,A, 19289/76 (STANDERWICK) 11 May 1978 (11.05.78) See pages 1-5, and drawings.	(1-6)
X	US,A, 3512447 (VAUGHN) 19 May 1970 (19.05.70) See columns 3-6.	(1-7)
X	US,A, 4037515 (KESSELMAN) 26 July 1977 (26.07.77) See columns 5 and 6.	(1-7)
X	US,A, 4729703 (KABUSHIKI KAISHA SUIKEN TECHNOLOGY) 8 March 1988 (08.03.88) See columns 2 to 4.	(1-6)
X	FR,A, 2560100 (SIMEL SOC IND MAT) 30 August 1985 (30.08.85) (continued)	(1-7)

* Special categories of cited documents : [10]

"A" Document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior t the international filing date but later than the priority date claimed

"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 November 1991 (11.11.91)	18 November 91
International Searching Authority	Signature of Authorized Officer
AUSTRALIAN PATENT OFFICE	D.G. FRY

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X	Derwent Abstract Accession no. H4727B/35 Class Q61, SU,A, 634023 (POSTEEV) 28 November 1978 (28.11.78)	(1-6)
X	Derwent Abstract Accession no. E2225C/19 Class Q61, SU,A, 684181 (SOYUZNEFTEAVTOMATIK) 8 September 1979 (08.09.79)	(1-6)

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4a

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL APPLICATION NO. PCT/AU 91/00370

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member		
US 3512447	BE 738553	CH 510827	DE 1944805
	GB 1252834	NL 6913540	
US 4729703	JP 62046986	DE 3640668	GB 2183768

END OF ANNEX

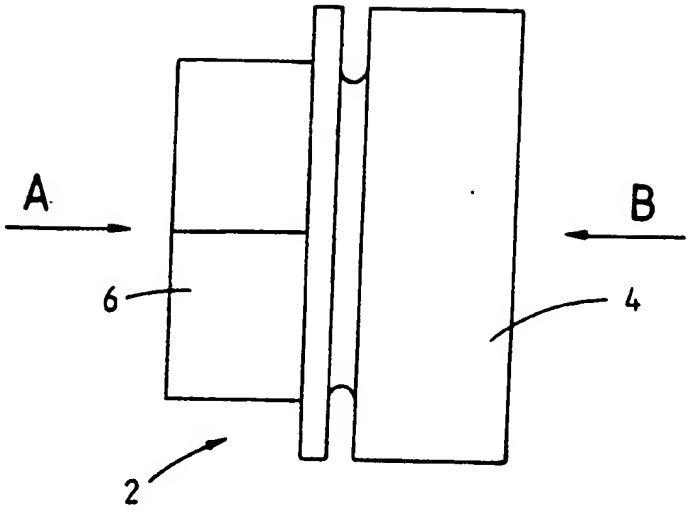


FIG. 1

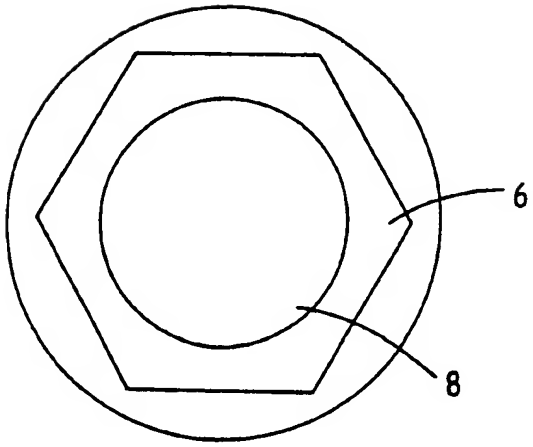


FIG. 2

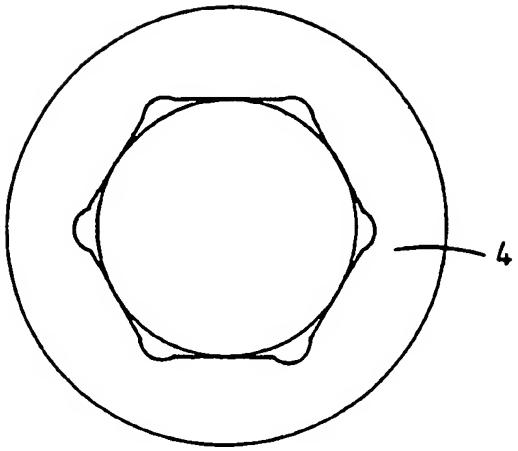


FIG. 3

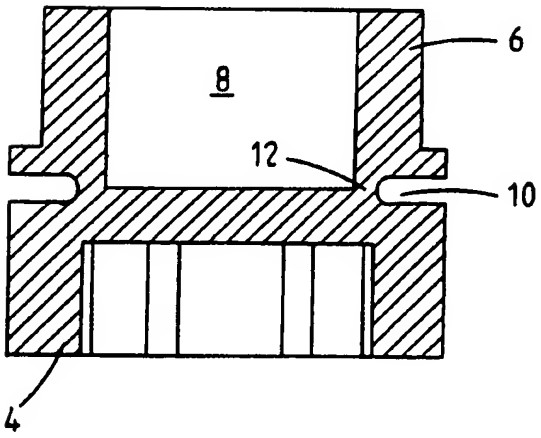


FIG. 4

"TIGHTENING DEVICE FOR A THREADED FASTENER"

The present invention relates to a device for tightening a threaded fastener to a prescribed torque and more particularly, but not exclusively, to a device for tightening to a prescribed torque an expansion bolt or nut of a masonry anchor.

One well known form of masonry anchor comprises a sleeve which is expanded into engagement with the wall of a hole drilled into masonry by drawing an expansion element into the sleeve upon tightening of a bolt or nut of the anchor. When an anchor of this type is used in a high stress fixing application it is necessary that the bolt or nut is tightened to a specified torque. Although this can be achieved by using a torque wrench, these are not always readily available on a building site and, furthermore, even if a torque wrench has been used, it cannot be ascertained on subsequent inspection that the fastener has been tightened to the required torque.

There has been proposed in U.S. patent 4,144,796 a masonry anchor of the type described above, in which the bolt head carries a hexagonal tightening cap which is connected to the head by shear pins which shear at a predetermined torque applied between the cap and the head. The assembly of the cap to the bolt head by means of the shear pins significantly increases the cost of the masonry anchor and also a different bolt and shear pin combination (and hence a different anchor) needs to be provided for each different required torque setting.

There has also been proposed a torque limiting socket which can be placed over a bolt head or nut and which fails by tearing of the socket portion when a predetermined torque has been exceeded. Such a socket is disclosed in U.S. patent 4,215,600. In this previously proposed socket, failure takes place by tearing of the wall of the socket portion and it is not possible to control

with accuracy the precise torque at which tearing occurs.

According to the present invention there is provided a tightening device for a threaded fastener such as a bolt or nut, comprising a socket portion for co-operation with the threaded fastener, a driving portion spaced from the socket portion and shaped for engagement by torque-applying means, and a torque-transmitting zone connecting the driving portion to the socket portion, said torque-transmitting zone being integral with the body portion and socket portion and adapted to shear at the application of a predetermined torque.

Advantageously, the torque-transmitting zone is of thin walled form, preferably of annular form.

In a preferred embodiment of the invention, the annular torque-transmitting zone is defined by an annular land extending between the base of an annular groove opening onto the external surface of the device and an axial bore within the interior of the device whereby the torque characteristics can be varied by changing the depth of the groove and/or the diameter of the bore. The driving portion preferably completely separates from the socket portion on shearing of the torque-transmitting zone, and advantageously, the socket portion is a tamper-resistant fit on the bolt head or nut whereby to remain attached to the bolt head or nut so as to provide visual indication of removal of the socket portion therefrom after shearing of the torque-transmitting zone.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a torque limiting tightening device in accordance with the invention;

Figure 2 is an end elevation in the direction of arrow A in Figure 1;

Figure 3 is an end elevation in the direction of arrow B in Figure 1; and

Figure 4 is a longitudinal section through the device.

There is shown in the accompanying drawings a tightening device for a bolt or nut and more particularly, but not exclusively, for a bolt or nut of a masonry anchor of the type described above incorporating an expansion sleeve which is expanded by the application of torque to the bolt or nut to draw an expansion element into the sleeve. The tightening device is in the form of a torque limiting socket 2 comprising a socket portion 4 adapted to fit over the bolt head or nut and having an internal profile to provide driving engagement with the bolt head or nut, and axially spaced from the socket portion 4, a driving portion 6 having an external profile shaped to cooperate with a wrench or spanner. In the particular form shown, the driving portion 6 is of hexagonal shape. The driving portion 6 is of hollow construction to provide a cylindrical bore 8. The body of the socket between the driving portion 6 and the socket portion 4 includes an external annular groove 10 the base of which lies adjacent to the end portion of the cylindrical bore 8 whereby the groove 10 and bore 8 define a thin-walled annular zone or land 12 between the driving portion 6 and the socket portion 4 and via which torque is transmitted from the driving portion 6 to the socket portion 4. At the application of a predetermined torque, the thin-walled annular zone 12 will break whereby the driving portion 6 separates from the socket portion 4 thereby preventing the application of further torque.

The socket is integrally formed by moulding from a suitable plastics or alloy.

In the socket described, the torque-limiting function is achieved by shearing of a thin-walled zone and the torque at which shearing occurs is accurately determinable and is repeatable from sample to sample. In the form described in which the thickness of the thin-walled zone is determined by the width of the annular land 12 remaining between the base of the external groove 10 and the cylindrical wall of the internal bore 8, the torque characteristics can be varied simply by varying the width of the land 12 and

hence by altering the depth of the groove 10 and/or the diameter of the bore 8. The depth of the groove 10 and the diameter of the bore 8 can be altered simply, by using a different insert in the relevant section of the mould. Accordingly a range of torque limiting sockets to suit different torque conditions can easily be achieved without effecting any significant redesign.

The socket portion 4 is so constructed as to remain attached to the bolt head or nut after the annular zone 12 has sheared and the driving portion 6 has separated from the socket portion 4 in order to provide a visual indication that the bolt or nut has been driven to the prescribed torque and hence that the masonry anchor has been correctly set. The external surface of the socket portion 4 is also of a profile (as shown a cylindrical profile), which ensures that it cannot easily be gripped by a wrench in order to apply additional torque directly to the socket portion 4 after shearing of the driving portion 6. In order to provide attachment of the socket portion 4 to the bolt head or nut so as to prevent easy removal after separation of the driving portion, the socket portion 4 may be sized to be a tight fit on the bolt head or nut, and/or the socket portion 4 may include at its outer end lugs which snap into engagement over the remote edge of the bolt head or nut. Although neither or these measures will act to prevent removal of the socket portion 4 if sufficient force is applied, the application of force to remove the socket portion 4 will result either in marking of the socket portion 4 or breakage of the lugs so that if an operator attempts to remove the socket portion 4 to permit the application of additional torque directly to the bolt head or nut and then reapplies the sheared socket portion, there will be a visual indication that the socket portion 4 has been tampered with.

In the embodiment shown the retention of the socket portion 4 is achieved by shaping the internal profile of the socket portion 4 to provide a hexagonal profile with the sides of the hexagon being somewhat convex to provide high contact pressure with the flats of the bolt head or nut.

Torque limiting driving sockets as described herein can be provided separately from the masonry anchors (or other components) with which they are to be used and no modification is required to the anchor itself. A range of sockets can be provided to suit different torque conditions and the individual sockets within the range can be colour-coded in order to permit ease of identification.

In an alternative, the torque limiting socket can be moulded around the head of a bolt whereby the head of the bolt is embedded within the socket portion 4 during manufacture.

The embodiment has been described by way of example only and modifications are possible within the scope of the invention.

CLAIMS:-

1. A tightening device for a threaded fastener such as a bolt or nut, comprising a socket portion for co-operation with the threaded fastener, a driving portion spaced from the socket portion and shaped for engagement by torque-applying means, and a torque-transmitting zone connecting the driving portion to the socket portion, said torque-transmitting zone being integral with the body portion and socket portion and adapted to shear at the application of a predetermined torque.

2. A tightening device according to claim 1, wherein the driving portion is axially spaced from the socket portion.

3. A tightening device according to claim 1 or claim 2, wherein the torque-transmitting zone is in the form of a thin-walled zone.

4. A tightening device according to claim 3, wherein the thin-walled zone is of annular form.

5. A tightening device according to claim 4, wherein the annular thin-walled zone is defined by an annular land extending between the base of an annular groove opening onto an external circumferential surface of the device and an axial bore within the interior of the device.

6. A tightening device according to any one of claims 1 to 5, wherein the driving portion completely separates from the socket portion on shearing of the torque-transmitting zone.

7. A tightening device according to any one of claims 1 to 6, wherein the socket portion includes means for providing a tamper-resistant fit on the threaded fastener.